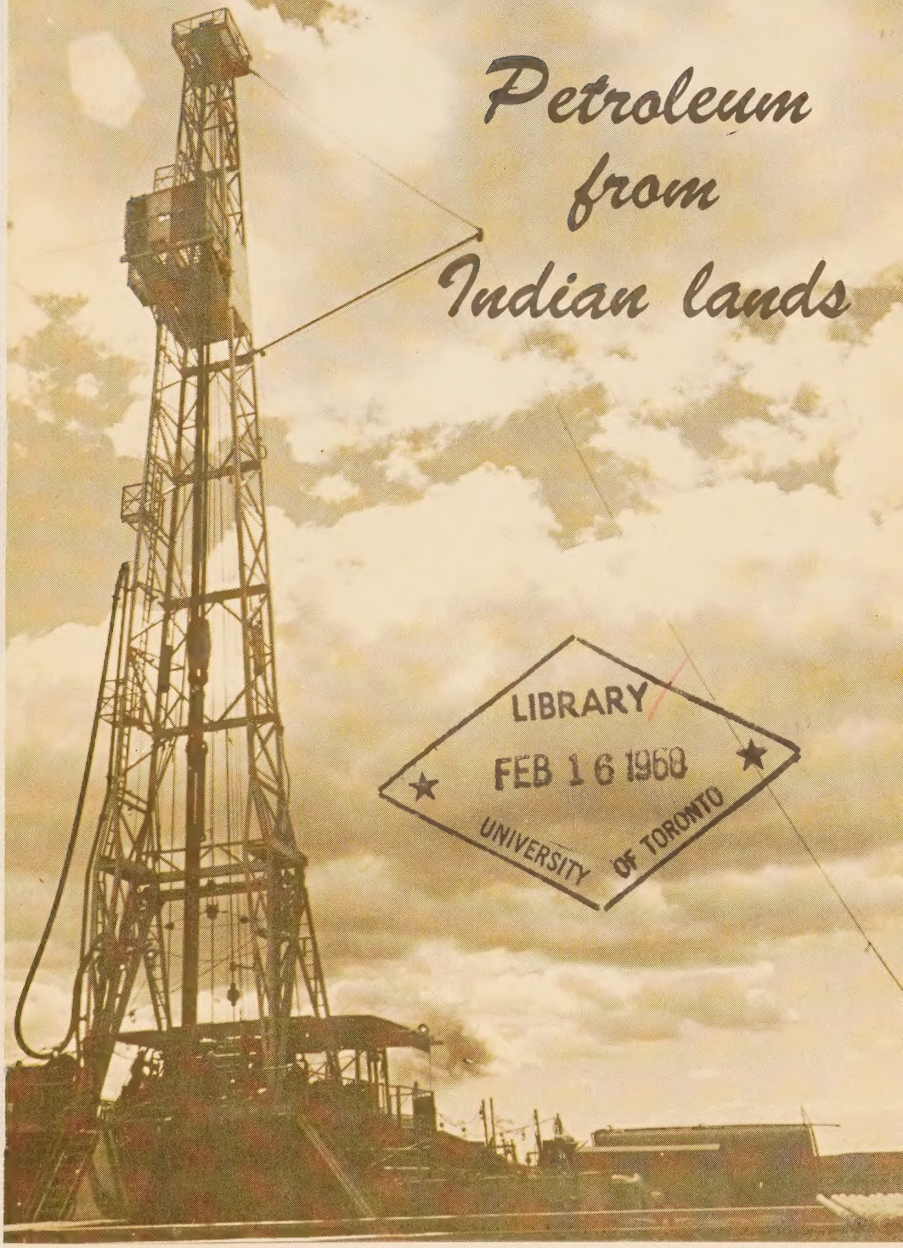
Petroleum from Indian lands



Department of Indian Affairs and Northern Development

Petroleum from Indian lands

Issued under the Authority of the
Honourable Arthur Laing, P.C., M.P., B.S.A.
Minister of Indian Affairs and Northern Development
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PETROLEUM FROM INDIAN LANDS

Preface

Resources which lie below the surface of the land are somewhat of a mystery for seldom are they easily found. In the present day search for oil and gas, highly specialized techniques are used.

This booklet is intended to inform the Indian people about petroleum on their lands:

How it is formed

Where it may occur

How it is found and produced

What is expected of the oil and gas developers, the Indians and Indian Affairs Branch in leasing, developing and producing the product

What benefits are received by the Indians.

Information provided here should also be of value to the developer interested in knowing of petroleum prospects and development policy for Indian lands.

OIL AND GAS RESOURCES

NATURE AND ORIGIN

The name "*petroleum*" comes from the ancient Greek language and means "rock oil". Petroleum occurs as a gas, a liquid, a solid, or as a mixture of these. Petroleum is a mineral, but one derived from dead, organic matter.

Petroleum in the form of gas is often called natural gas to distinguish it from manufactured gas. Natural gas as it comes out of the ground is made up of many compounds of hydrogen and carbon and it may also contain a number of impurities such as water, hydrogen sulphide, carbon dioxide, nitrogen, oxygen and helium. Before being used, most natural gases have to be cleaned to remove the impurities and then separated into residue gas, propane, butane and gasoline. Separation generally takes place in large, highly complex gas plants. The predominant component of natural gas is residue gas which is composed largely of methane and ethane. While large quantities of residue gas are consumed by the chemical industries, by far the greatest quantities are used as a heating fuel in homes and other buildings.

Petroleum in the liquid form is called crude oil, or just oil. Like natural gas, crude oil consists mainly of hydrogen and carbon compounds which must be separated from each other before using. The separation takes place in an oil refinery, which produces from the crude oil such products as gasoline, stove oil, diesel fuel, bunker fuel, grease, asphalt and even some natural gas.

The third type of petroleum called tar or bitumen occurs in the solid or semi-solid state. The largest economic deposit in the world is in the Athabasca River area of northeastern Alberta. This deposit has only slight amounts of petroleum in the form of liquid or gas. Hence it is virtually a solid mixture of bitumen and sand.

Petroleum is believed to have been formed from the remains of salt water plants and animals. Millions of years ago much of the land was covered by great inland seas which were connected to the oceans. Plants and animals lived and died in these seas and were buried under layers of sand and mud which settled to the sea bottom. As the sand, mud, plant and animal remains were pressed together, the oil substances from the plants and animals formed drops of oil and gas. The sand and mud changed to hard rock such as sandstone and shale. These were subjected to stress in the earth's crust resulting in folding. With these changes, tiny drops of oil and gas from the plants and animal remains were forced up by earth pressures through the pores in the rocks until they were trapped and could go no further. Where the traps were large and pore spaces were abundant, pools of oil and gas were formed. (*See Fig.* 1-6)

Certain conditions in the rock strata are favourable for the formation of pools of oil and gas:

a) Petroleum occurs in sedimentary rocks which were laid down in layers in ancient lakes or seas.

b) There must be spaces or pores between the particles of solid rock to give room for the oil and gas to accumulate.

c) There must be a trap to keep the petroleum fluids from leaking away into the surrounding rocks or from seeping up to the surface. The trap is usually a dense cover rock which cannot be penetrated by oil and gas. The trap may take different forms such as a dome in in a porous rock layer, a fault sealing off a porous rock layer, a sand lens covered by dense rock, or a porous coral reef covered by shale. *(See Fig. 7-10)*

Fig. 1. Many Geologists believe that the source materials of petroleum are low forms of marine life which lived millions of years ago in ancient seas.

Fig. 2. As these tiny creatures died they settled in the bottom muds of lagoons or in depressions on the floor of shallow seas where they mixed with layers of mud and sand.

Fig. 3. Gradual decay, heat, pressure and bacterial action changed the organic matter into the "mother" material of oil.

Fig. 4. With the passing of millions of years and the deposition of more layers of sediments, pressure formed the layers of mud and sand into layers of rock.

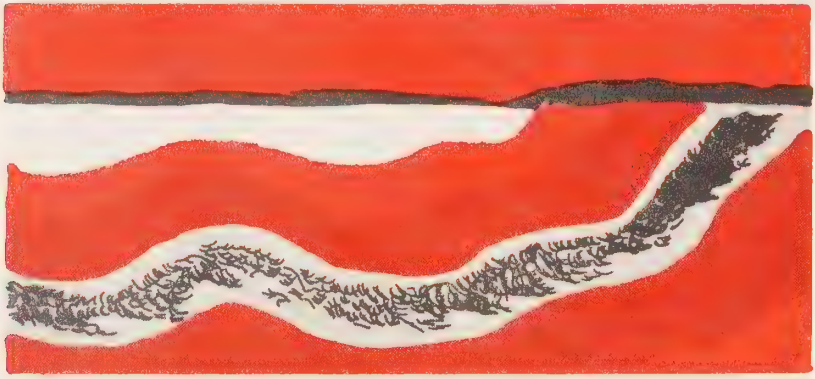


Fig. 5. Under stress and strain the earth's crust cracked and folded.

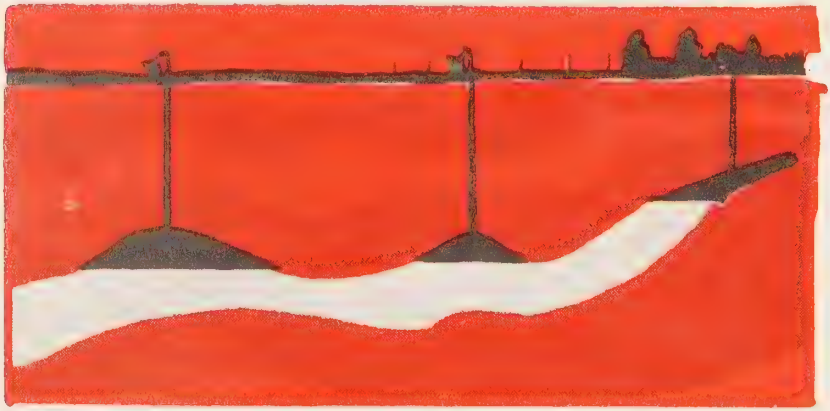


Fig. 6. Oil in these deeply buried sediments migrated upward through porous rock until it was either lost at the surface or "trapped" under non-porous rock.

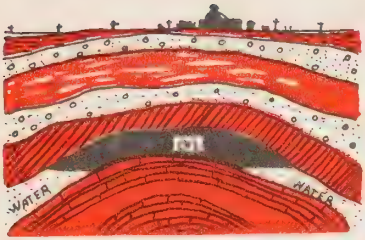


Fig. 7. Structural Trap Caused by Folding into a Dome

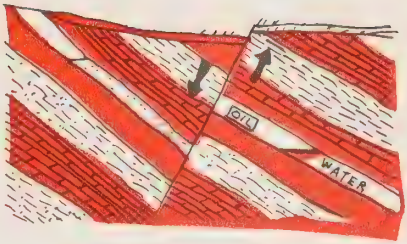


Fig. 8. Structural Trap Caused by Faulting

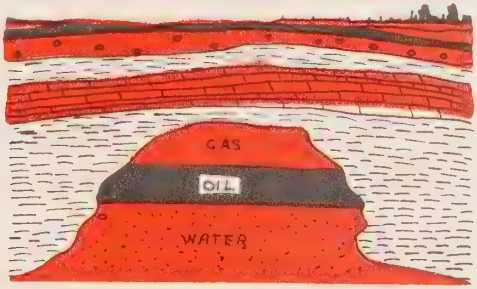


Fig. 9. Stratigraphic Trap: Lenses of Sand in Shale

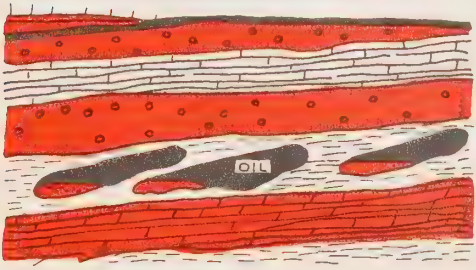


Fig. 10. Stratigraphic Trap: Coral Reef Buildup in Shale

OCCURENCE

Oil and gas are found in regions of Canada where the underlying sedimentary formations such as sandstones, shales and limestones, are relatively undisturbed or are only gently folded and faulted. The Interior Plains Region of western Canada is the largest area which fits all these requirements. This region covers most of Alberta and Saskatchewan, northeastern British Columbia, southwestern Manitoba, much of the western Territories and extends into the Arctic Lowlands and plateaux. Regions of less importance are the St. Lawrence Lowlands of Ontario and Quebec and the Hudson Bay Lowlands of Ontario and Manitoba.

The amount of oil and gas found in these regions increases with the thickness of the sedimentary formations. Central and southwestern Alberta, where the sedimentary formations are very thick, produces much more oil per average township than a township of land along the fringes of the Precambrian Shield where the sedimentary formations are thin.

EXPLORATION

The geologists for oil companies prefer to search for oil in parts of Canada where the sedimentary formations are relatively thick, for here chances of discovery are greater. Within these thick formations they seek for suitable reservoir rocks: those which have pore spaces to allow the oil and gas to accumulate, and which have suitable traps to contain and preserve the pools until they are tapped by the drill.

In the early days of exploring for oil, prospectors looked for seeps of oil at the surface. In some cases the seeps were evidence of valuable pools of oil below. An oil seep discovered by an Indian resulted in the development of Norman Wells field in the Northwest Territories in 1920. In other cases the seeps proved to be the last remnants of the pools of former ages. Today, oil is found largely by highly scientific methods.

An oil company normally starts off exploratory work in a region by collecting in its office all known information from the work of government surveys and other companies. The collection includes air photographs, geological maps and reports, geophysical data and drilling results. Some of this information which is not published must be obtained by exchange or by purchase.

Once the available information is compiled and interpreted, the company is ready for field exploration. A survey of the surface geology to map any exposures of formations is the first stage of exploration and the least expensive one. The next stage is to determine the nature and shape of the underlying geological formations by indirect means such as geophysics or structure test drilling. There are a wide variety of geophysical methods, so only some of the more common will be mentioned: seismic, gravity and magnetic.

a) *Seismic*

Shallow holes are drilled and the bottom of each hole is loaded with dynamite and blasted. *(See Fig. 11).* Delicate instruments measure the time that the shock from the explosion takes to travel down to a rock layer and reflect back to the surface. From this measurement of time, the distance from the surface to the rock layer can be calculated. Many such measurements may not only indicate the distance to the rock layer at different localities but also the shape of the rock layer at great depth. Under some conditions the seismic method does not yield usable results. Where reflections of the shock waves are not clear enough to determine the shape of the rock layer, a number of shallow structure test holes may be drilled. The depths to the different shallow formations can then be determined from the nature of the rock brought up by the drill and from the geophysical measurements taken in the hole. This information is then used to forecast the shape of the deeper rock layer.

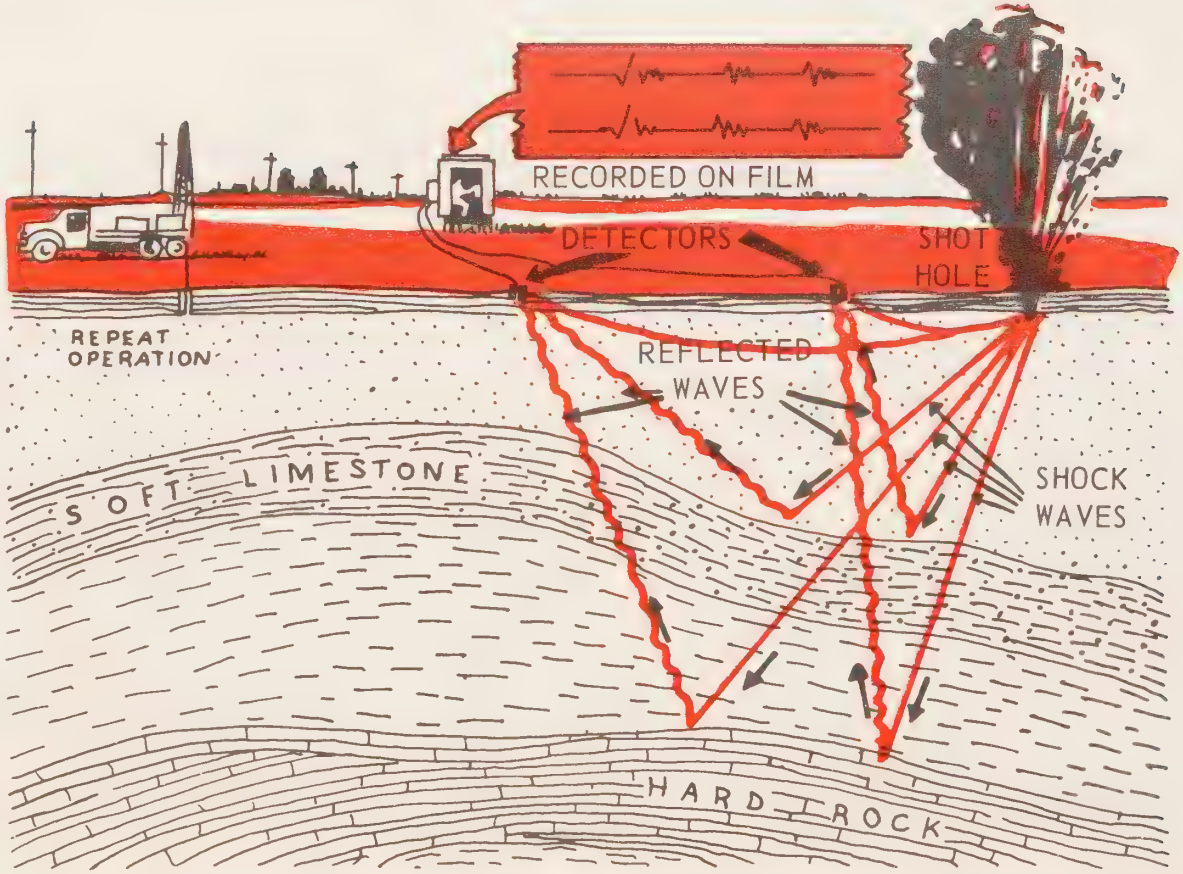


Fig. 11. Searching for Oil by Means of the Reflection Seismograph.

b) *Gravity*

A gravity meter survey measures slight variations in the gravitational force of the earth from one locality to another. These variations are caused by changes in density of the underlying formations and may indicate a structure that could contain oil.

c) *Magnetic*

The magnetometer measures changes in intensity of the earth's magnetic field and may indicate unusual topographic shapes on the surface of the underlying basement rock.

DRILLING

Geological, geophysical and structure test hole surveys give only some clues as to the location of geological features favourable for oil and gas accumulations. To prove the presence of paying quantities, a well must be drilled.

In western Canada nearly all exploratory *(wildcat)* and development wells are drilled by rotary rig in contrast to southwestern Ontario where the productive formations are shallow. Most wells there are drilled by cable tool rig which has a chopping action. As the rotary rig is the most widely used, its operation will be described briefly here. *(See Fig. 12).*

The rotary rig has a derrick about 100 feet or more in height, draw works and other parts needed to drill holes many thousands of feet below the surface. The draw works are usually powered by diesel engines strong enough to pull 5,000, 10,000 or even 25,000 feet of heavy drill pipe, drill collar and drill bit from the hole. The draw works also operates the rotary table which turns the drill pipe that in turn rotates the rock drill as it grinds its way into the rock. Drilling mud is pumped into the drill pipe. This flushes the rock cuttings away from the drill bit up to the surface between the drill pipe and the wall of the hole. At first a large bit is used to drill a hole several hundred feet in depth into which steel surface casing is run and cemented into place. This surface casing protects the well against

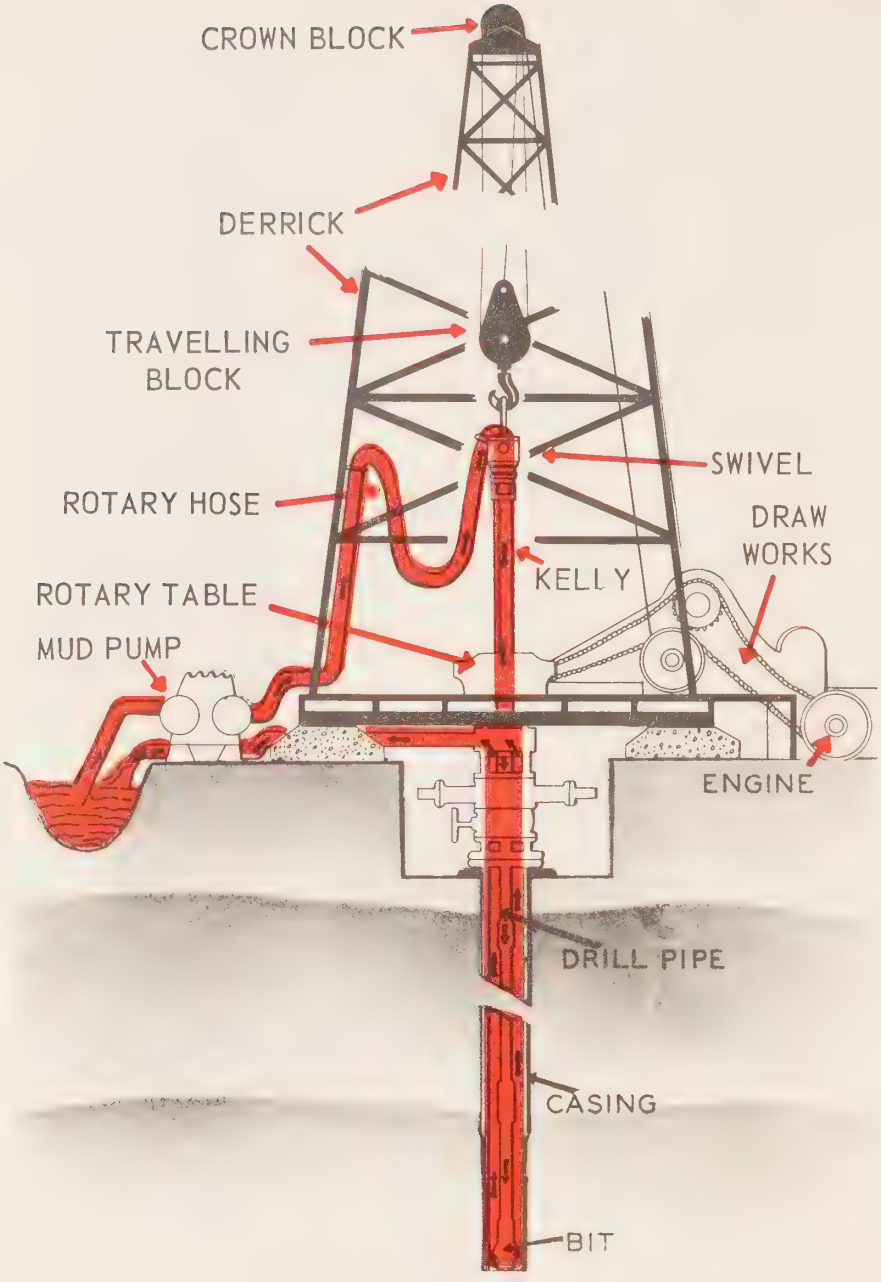


Fig. 12. Rotary Drilling Rig.

caving of the hole, prevents contamination of nearby water wells, and serves as an anchor for safety devices such as a blowout preventer.

The drill cuttings which are carried to the surface by the drilling mud are screened, washed and examined by the geologist who plots the progress of the well from one formation to another and watches for porosity and oil staining. Formations expected to contain oil or gas may be cored by attaching a diamond bit and core barrel to the drill stem. To measure the capacity of a rock formation to produce oil or gas, a drill stem test may be taken by using a tool designed to allow the formation fluid to enter the drill pipe.

Once the drilling is finished different types of mechanical or geophysical logs are taken of the hole. Proper interpretation of the logs, core samples and cutting samples will determine the nature of the strata penetrated, where the pore spaces are, what proportion of the rock is porous, and how much of the pore spaces are filled with oil, gas or water.

If commercial quantities of oil and gas have been found, production casing is run into the productive formation and cemented in place. If oil or gas has not been found the well is abandoned by placing cement plugs to seal off porous formations.

PRODUCTION

Production facilities for oil fields and gas fields are somewhat different. Only those for an oil field will be described here. Following the setting of production casing in an oil well, a smaller string of pipe called tubing is run into the hole. It is through the tubing that oil flows after the well has been completed for production.

There are two types of oil wells, flowing or pumping. Oil may flow to the surface, driven by pressure of the gas or other formation fluids. On the other hand the pressure at the bottom of the well may not be sufficient to raise the oil to the surface and therefore a pump is necessary to obtain production. Often a flowing well will gradually lose

its pressure until a pump is required to remove the oil during the last years of production.

Normally a number of oil wells are produced to a common production facility referred to as a production battery. Each well is connected to the battery by a flow line. The crude oil at the battery first enters a separator in which gas is removed from the oil. If the quantities of gas removed are small they may be burned in the flare pit. On the other hand if quantities are large the gas may be gathered, measured and piped to a gas plant where the gas is treated to remove impurities and separated into components. Salable products may include residue gas, propane, butane, condensate and sulphur.

The oil from the separator may require treatment to remove water in which case it is usually routed through a treater. From the treater the oil is run into storage tanks where it is measured and then transported to a refinery by pipeline, truck or railway tank car.

MINERAL SURRENDERS

The manner in which Indian lands and minerals may be developed and managed is governed by the Indian Act. The Act says that a *"band"* is the body of Indians for whose use and benefit reserve lands have been set apart. It is generally understood that minerals are a part of such lands. Legal title, however, is vested in the Crown in the Right of Canada so that the Indian right to the lands may be safeguarded.

Indians occupying land on their reserves have no individual right to the minerals under their property. The Band as a whole receives the benefit from the development of minerals. An individual receives direct benefit only on a *"per capita"* basis as a Band member. However, if the surface of the land is damaged or removed through the development of minerals, the individual occupant of that land has the right to compensation.

Minerals, being non-renewable, may be developed only after the Band has "surrendered" the mineral lands in the manner provided by the Indian Act. The "surrender" which is authorized by a vote of the electors of the Band and accepted by Governor in Council, places the mineral rights in trust with the Queen to lease for the benefit of the Band. "Surrender" here means nothing more than giving approval for developing and producing the minerals for the Indian benefit.

PROSPECTIVE OIL AND GAS AREAS

An appraisal has been made by the Head of the Minerals Section, Indian Affairs Branch, of the capabilities of the Indian reserves within the provinces of Alberta, Saskatchewan, British Columbia and Manitoba to produce oil and gas. His appraisal is based upon the estimated content of oil and gas for each cubic mile of sedimentary rock underlying the reserve lands. The estimated content, in turn, is the result of experience in parts of North America where the petroleum resources are fully developed.

One cubic mile of sedimentary rock is assumed to be capable of producing about 70,000 barrels of oil and 420,000,000 cubic feet of gas. On this basis the amount of oil and gas expected to be recovered from the Indian lands has been estimated and is summarized in the following table for the four western provinces. Improvements in the methods for recovering the oil and gas are increasing these ultimate reserves.

Summary of Ultimate Virgin Reserves of Recoverable Oil and Gas from Indian Lands in the Interior Plains Region of Western Canada

Province	Favourable Area – Acres	Volume Cubic Miles Sedimentary Rock	Reserve Oil Millions Barrels	Reserve Gas Billions Cubic Feet
Alberta	1,505,370	4,076	283 +	1,698 +
Saskatchewan...	1,109,060	1,612	112	672
B.C.	22,560	116	8.0	48
Manitoba	91,715	102	7.2	43
	2,728,705	5,906	410.2	2,461

+ For comparison, Alberta production from Indian lands during 1966-67 amounted to 3.64 million barrels of oil and 17.7 billion cubic feet of gas.

Experience to the present time indicates that a cubic mile of sedimentary rock in Saskatchewan has not as high an oil and gas content as a cubic mile of rock in Alberta. Although the table indicates that ultimate production from Saskatchewan reserve lands should amount to over one third the production from Alberta, production to date in Saskatchewan is only a very small fraction of that for Alberta. Future discoveries in Saskatchewan could change this picture.

HISTORY OF DEVELOPMENT

Records show that oil and gas regulations for Indian lands were in effect as early as 1910. However, the first production of note was in Ontario on the Six Nations Reserve where gas was developed in the late 1920's. The gas supply which provides fuel mainly for domestic purposes has declined to the point where in recent years it averages only 20 million cubic feet annually from 20 wells. In western Canada such low production is far from the economic minimum of about one million cubic feet per day per well. There has been no other production in eastern Canada although

recent discoveries of oil in the Cambrian formation in southwestern Ontario has stimulated interest in exploring the Indian reserves for oil.

The discovery of oil at Leduc in Alberta in 1947 marked the beginning of sustained exploratory programs on Indian lands in western Canada. Discoveries of importance that include the Acheson and Bonnie Glen oil fields, were made on Indian reserves. The accompanying map points out areas where oil and gas have been developed on Indian lands in Alberta.

Gas was discovered on the Beaver Lake and Blackfoot reserves in Alberta but is not yet being produced because of lack of local markets. The richest gas fields are producing in the Rocky Mountain Foothills region from the Mississippian formation. An example of this is the Lookout Butte field on the Blood Timber reserve, where a gas cycling scheme has been in operation for four years. The gas is stripped of rich liquid condensates and then reinjected back to the formation. Starting late 1967, gas, in addition to the condensates, will be produced to a market. Royalties from this field to the Blood Band will average over $20,000 per month. Other fields in the Prairie region produce from the much shallower Lower Cretaceous formation.

During the period from 1963 to 1967, oil has been discovered and developed on Indian reserves in northwestern Alberta in the Middle Devonian formation. The Mitsue field at the east end of Lesser Slave Lake covers portions of the Sawridge reserve lands and the Nipisi field east of Utikuma Lake includes lands of the Whitefish Lake band. Oil has been encountered also on the Sturgeon Lake reserve 200 miles northwest of Edmonton and on the Hay Lake reserve in the area of the rich Rainbow field. Oil is produced from shallower formations such as the Blairmore at the Samson reserve and the Cardium at the Pigeon Lake reserve.

The bituminous or tar sands area of the Athabasca River in northwestern Alberta encompasses several Indian reserves. The Gregoire Lake reserve 20 miles southeast

of Fort McMurray has been the testing ground since 1962 for an "enhanced recovery" process for producing the heavy oil from a depth of over 1000 feet. The Clearwater and Fort McKay reserves, also in the same region, were used in 1965 to test a process for separating bitumen from sand following mechanical excavation. Although economic reserves of oil in the Athabasca bituminous sands area are the largest in the world, problems of production, transportation and market have delayed production. This year (1967) the first oil will be produced commercially from the Athabasca area and there is prospect of future production from Indian lands.

Heavy gravity oil was encountered in the Lower Cretaceous sands on the Saddle Lake reserve, west of St. Paul in northeastern Alberta, as early as 1952. Although not as heavy as the oil from the Athabasca bituminous sands, the Saddle Lake oil will not flow readily through a well. Further heavy oil was encountered at Saddle Lake in 1958 and on the Cold Lake reserve, northeast of St. Paul in 1965. Oil resources in these areas are very great but they are not yet developed because of difficulties of production and lack ot market. Approval was given in late 1967 for a pilot program for producing the heavy crude oil of the Cold Lake reserve No. 149.

Today there are over 130 productive oil and gas wells on Indian lands in western Canada. Production from these fields is generating royalties for the Indian bands that have increased from a few hundred dollars in 1951 to the present yearly average of $1.5 million.

The exploration and production of oil and gas brings increasing income to the Indian people. It was in 1954 that revenues from rentals, bonuses and royalties first exceeded one million dollars. Since that time the level of revenues has increased with only minor fluctuations, until in 1965-66 it reached a record $4.6 million.

The successes in oil and gas developments have been largely confined to Alberta. However, exploration has ranged over a wide area through the Gulf Islands, lower Fraser Valley and Peace River areas of British Columbia to the prairie lands of Alberta, Saskatchewan and southwestern Manitoba.

INDIAN OIL AND GAS REGULATIONS

Through the passing of an oil and gas "surrender" by a Band and the acceptance by Governor in Council, Indian reserve lands are made available for leasing and development. The Indian Oil and Gas Regulations, P.C. 1966-1271 govern the manner in which leasing and development take place.

(a) *Oil and Gas Permit*

When a large area of Indian land is available for petroleum prospecting, the right to explore is advertised for sale by public tender as a permit both in an oil industry journal and by letter to oil companies. Usually a month or more is allowed until the day of the sale so that oil companies may have a chance to make an appraisal; that is, to have a quick look at the prospects of finding oil. The tender sent in by any oil company will include the first year's rent and a cash bonus. The highest cash bonus is accepted providing that it is in line with the estimated value of the area.

The oil and gas permit gives the right to explore for oil and gas over a certain area but does not allow oil or gas to be produced. The person holding a permit also has the right to lease one half of the area of the permit. The permit is given for only one year with rent at 20¢ per acre. Extensions of the permit may be granted for up to a year at a time with rentals increasing to 30¢ per acre for the second year, 4¢ per acre per month for the third year and 6¢ per acre per month for the fourth and following years.

The holder of the permit is required to do some type of work in the area to establish whether or not oil and gas is present. Exceptions are made when prospects are not attractive. If the government were to insist in all cases on the permit holder spending money on exploring for oil and gas, often the permit would be given up without finding anyone to take it up again. This would result in losing the permit rental for the band funds.

Money spent by the permit holder on exploring the area may be allowed as credit to reduce rent for the first two years on leases selected out of the permit. This system of allowing credit on the permit for exploration costs has the effect of encouraging permit holders to take out leases rather than surrender the rights, where results have not been good.

(b) *Gas Licence*

A gas licence is taken in a similar manner to an oil or gas permit. The licence however restricts the right of the holder to the gas only for one or more specified formations. Annual rents are at a lower rate than the permit but the licence obligates the holder to drill if he wishes to acquire a lease to produce. The area available for lease selection depends upon the number and depth of wells drilled during the gas licence stage.

(c) *Oil and Gas Lease*

A small area of Indian land, which is not held by permit or lease, may also be advertised for sale by public tender as a lease, in the same way that a larger area is advertised for sale as a permit. The person offering the highest bonus is granted the lease providing the tender reflects the estimated value of the lease area. A lease bought in this way, or selected from a permit, has a life of ten years, with rent prepaid each year at $1.00 per acre. The Supervisor of Minerals may require the lease holder to drill on a location adjoining a producing well. However, he seldom makes this demand, for an oil company which finds oil or gas after spending vast sums of money on exploration and drilling, will need no persuasion to develop its discovery by further drilling.

The oil and gas lease grants the right to produce oil, with royalties payable to the Indian Band fund. Royalties on oil production are on a sliding scale. Where the well is a poor producer the present regulations provide that one barrel of oil for every ten produced goes to the Indian Band fund. Where the well is a good producer, one barrel for every five produced is paid to the Band. Royalties on gas amount to one sixth of the value of the gas produced from the well. Rates of royalty on older leases are lower than these rates. In practice the producer sells the Indian share of the oil and gas and pays the royalty in cash each month.

A lease that expires can be renewed for another ten year term if oil or gas is being produced. On the other hand, if a lease is not producing at the end of the term, it is not renewed, except under special conditions.

Where no bonuses are offered for lands put up for sale either as permits or leases, the unsold parcels may remain available for a specified period of up to six months from the date of the sale during which time companies can submit a tender. The one offering the highest bonus during this period may be granted the permit or lease provided the bonus is considered equitable in the light of information available at that time.

The newer regulations provide for companies taking up rights to gas only, where oil rights are not required. Annual rentals for the gas licence and the gas lease are lower than for similar contracts for both oil and gas.

(d) *Surface Lease*

A person drilling an oil well must take out a surface lease covering the land needed for the site of the well and for an access road. The average area of land required for a surface lease is five acres. The person holding the oil and gas rights must negotiate with the Band Council and any Indian occupant to decide on the amount of money to be paid for the lease. Where land is valuable and under cultivation the rate will be high, but where land is poor the payment will be lower.

In Alberta it is customary for the applicant, in dealing with non-Indian landowners, to pay an initial amount which covers the right of entry, severance, damage, incovenience, and rent for the first year. Usually this initial payment is a lump sum. A rate for rentals after the first year is also set at the time the lease is negotiated. This rental is generally based on the acreage and is paid annually in advance, the first payment becoming due and payable one year from the date of the lease. The amount to be charged for the initial payment and the rate of rentals will naturally vary from area to area. The method of appraising land for its value for well site and access road differs somewhat

from Alberta in the other provinces. The Band Council should seek advice from the Supervisor of Minerals at Calgary, Alberta, to assist in establishing a fair price.

PETROLEUM MANAGEMENT

The management of oil and gas rights is a complicated business. Most people who own such rights place them in the hands of a consultant or trust company, to arrange leases and to attend to all the management services. The consultant or trust company will see that all transactions are processed by engineers and lawyers specializing in the oil industry to ensure that the best possible terms are arranged. For the management of Indian oil and gas rights Indian Affairs Branch provides the Minerals Section to attend to these services. The Minerals Section is assisted by other units of Indian Affairs Branch: The Lands Surveys and Titles Section, the Land Transactions Section, the Trusts Section and the Treasury Office. The office of the Surveyor General of Canada also provides survey information.

The greater part of the services are provided by a unit of the Minerals Section located in Calgary and managed by the Supervisor of Minerals. These services include:

a) keeping records of Indian reserves with petroleum possibilities:

b) planning and supervising the sales of parcels of oil and gas rights;

c) compiling and maintaining technical records of exploration, drilling and production on Indian reserves;

d) acceptance and checking of rentals and royalties; and

e) the field inspections of oil and gas operations.

The Supervisor of Minerals keeps in close touch with the oil companies responsible for petroleum development on the Indian reserves to make sure that the Indian bands are receiving proper benefits.

Oil and gas rights are offered as permits, licences and leases by the Chief Officer of Indian Affairs Branch, usually in answer to requests from oil companies. He is assisted in this work by the staff of the Minerals Section

of the Resources and Industrial Division. Tenders are accepted at *"sales"* conducted in Calgary by the Supervisor of Minerals or by the Regional Director of Indian Affairs. Band Council representatives are invited to attend these sales to learn of the nature of the petroleum management work carried out by the Minerals Section on the Indian lands.

The Supervisor of Minerals and the Assistant Supervisor provide advice and information on petroleum matters to Band Councils. Councils should seek this advice particularly when negotiating agreements for surface leases for petroleum development.

The main purpose in the development of petroleum resources on Indian reserves is to provide revenues to Indian Band funds. These are of three kinds:

(a) *Rentals* are yearly payments for the oil and gas leases, permits, licences and surface leases. The amount of of each rental payment depends upon the acreage, the type of contract and, in the case of permits and licences, on the number of years the contract has been held. Rentals are paid into the Band Revenue account.

(b) *Bonuses* are the amounts paid in cash at the sales of the oil and gas rights and are paid into Band Capital account.

(c) *Royalties* represent the Band share of the oil and gas resources which are produced from the reserve. The land loses value as the petroleum is produced. For this reason, royalties also are paid into the Band Capital account.

PROVINCIAL REGULATIONS

Each of the provincial governments regulates and inspects the exploration, drilling, production and marketing operations for oil and gas within the provincial boundaries. Operators on Indian lands are required by the Indian Oil and Gas Regulations to comply with these provincial regulations.

INDIAN PARTICIPATION IN MANAGEMENT

Oil and gas resources are the hidden treasures of the Indian reserves. They are found today mainly by long, difficult and expensive searches that involve highly scientific methods of exploration and drilling. Companies engaged in the search are financed by millions of dollars of risk capital and are staffed by well-trained and experienced professionals. To ensure adequate management of the petroleum rights to Indian lands, managers with professional training and experience in petroleum work are required.

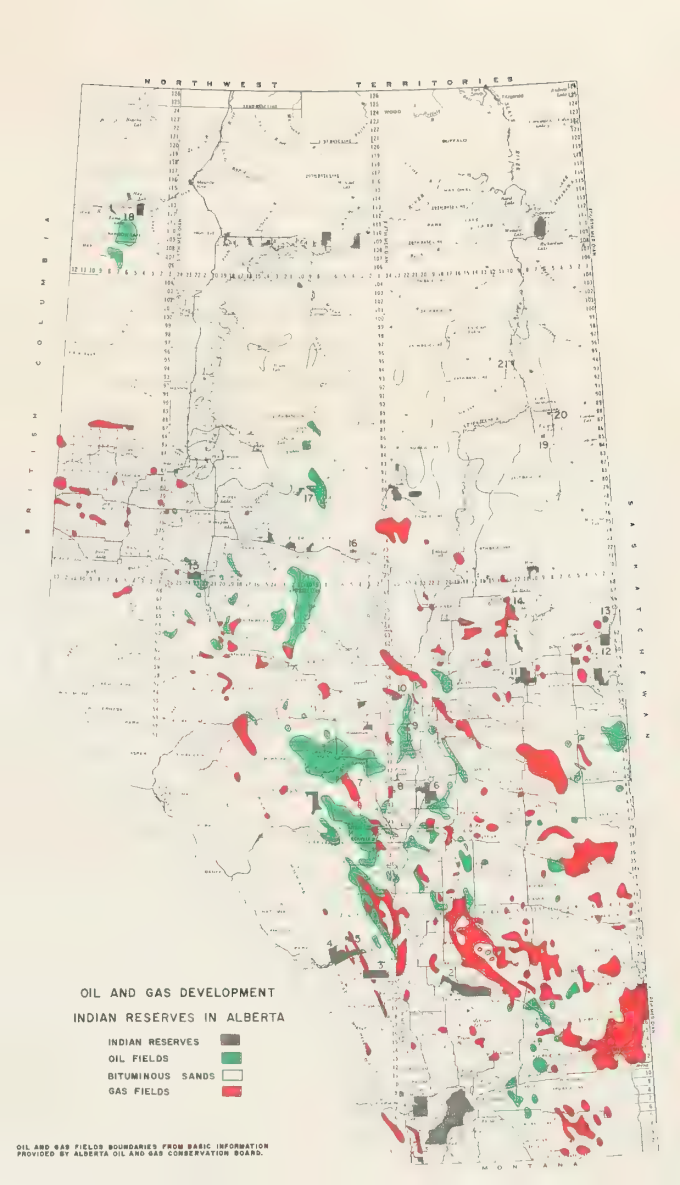
For some years Indian Affairs Branch has encouraged Indians to take an increasing share in the responsibilities for the management of their resources. Regional Indian Advisory Councils have been formed to consult with Indian Affairs Branch on new management policies and procedures. Indian Band Councils are becoming better informed on petroleum matters.

As Indians acquire new skills and gain more experience in petroleum activities, they will play a larger part in developing and managing their oil and gas resources.

Location	Indian Reserve	Field or Type of Oil	Formation	Number of Productive Wells	
				Oil	Gas
(1)	Blood Timber 148A	Lookout Butte	Mississippian	–	3
(2)	Blackfoot 146		Lower Cretaceous	–	1
(3)	Sarcee 145	Sarcee	Mississippian	–	1
(4)	Stony 142, 143, 144	W. Jumping Pound	Mississippian	–	1
(5)	Stony 142B	Wildcat Hills	Mississippian	–	2
(6)	Samson 137	Samson	Lower Cretaceous	1	2
(7)	Buck Lake 133C	Minnehik-Buck L.	Mississippian	–	1
(8)	Pigeon Lake 138A	Bonnie Glen	Upper Devonian	54	2
(9)	Stony Plain 135	Acheson and Yekau Lake	Upper Devonian	38	3
(10)	Alexander 134	Alexander	Lower Cretaceous	–	7
(11)	Saddle Lake 125	Heavy Oil	Lower Cretaceous	1	–
(12)	Cold Lake 149	Heavy Oil	Lower Cretaceous	–	–
(13)	Cold Lake 149B	Heavy Oil	Lower Cretaceous	–	–
(14)	Beaver Lake 131		Upper Devonian	–	2
(15)	Sturgeon Lake 154		Upper Devonian	4	–
(16)	Sawridge 150G	Mitsue	Middle Devonian	4	–
(17)	Utikoomak 155A	Nipisi	Middle Devonian	4	–
(18)	Hay Lake 209		Middle Devonian	1	1
(19)	Gregoire Lake 176	Bituminous Sands	Lower Cretaceous	–	–
(20)	Clearwater 175	Bituminous Sands	Lower Cretaceous	–	–
(21)	Fort McKay 174	Bituminous Sands	Lower Cretaceous	–	–

OIL AND GAS DEVELOPMENTS
INDIAN RESERVES IN ALBERTA

LEGEND


NORTHWEST TERRITORIES
BRITISH COLUMBIA
SASKATCHEWAN
MONTANA
OIL AND GAS DEVELOPMENT
INDIAN RESERVES IN ALBERTA
INDIAN RESERVES
OIL FIELDS
BITUMINOUS SANDS
GAS FIELDS
OIL AND GAS FIELDS BOUNDARIES FROM BASIC INFORMATION PROVIDED BY ALBERTA OIL AND GAS CONSERVATION BOARD.